

Centrarchid Spawning in the Florida Everglades

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KNOWLEDGE of the spawning characteristics and requirements of freshwater fishes is important to present day fish management. Predictions of future fishing success are sometimes made possible by knowledge of spawning activities. In some instances fish populations have been regulated by encouraging or discouraging the spawning of certain species. Water levels kept at the proper height during the spawning season of the shore-spawning species will permit a normal hatch while a drawdown can be used to suppress a population when it has become overcrowded. Treatment of the margins of a lake with a fish toxicant during spawning periods can also be used as an aid in reducing the numbers of an undesirable species.

Peninsular Florida is almost unique compared to the rest of the continental United States because much of it is subtropical and has little seasonal fluctuation in temperature. Old residents tell of year-round spawning of bass and the smaller sunfishes, but little information appears in the literature to establish the actual spawning periods of these species. Available information on centrarchid spawning in Florida is from the central portion of the state; an area approximately 250 miles north of the study area described in this paper.

THE STUDY AREA

In 1955 the Florida Game and Fresh Water Fish Commission undertook a number of studies to learn more about the fish populations and other aquatic life within three Conservation Areas in southern Florida located approximately 20 miles west of the Miami-Fort Lauderdale-West Palm Beach region. These three areas, totaling approximately 1,345 square miles, are a portion of the original Florida Everglades that is now enclosed by a vast network of levees and canals. The Conservation Areas were created to retain surplus water during the hurricane and rainy season, to regain irrigation water supplies in time of drought, to serve as potential reservoirs to maintain urban ground water tables, and to provide for fish and wildlife. These marshes and their bordering canals are the primary freshwater fishing areas of south Florida.

The majority of the investigations by the Game and Fresh Water Fish Commission were carried out in Conservation Area 2, a tract of 137,000 acres. The ground elevation slopes from about 13 feet to between 7-10 feet above mean sea level from north to south. Because of the gradual slope over a 15-mile stretch, a change of one foot in water level can either inundate or dry vast areas of marsh. The water depths in the southern portion of Area 2 range between 2-5.5 feet. The water level stages are established and controlled by the Central and Southern Florida Flood Control District.

SPAWNING SURVEY

Observations of spawning were made between December 1960 and July 1964 in Conservation Area 2. The levees around this area provided a berm or shelf of rock and clay on certain parts of which centrarchid nests were easily visible. While driving slowly along the levees, a biologist wearing polaroid glasses could look down without leaving the car and observe fish on the levee berm. The species observed spawning were: largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), and spotted sunfish (*Lepomis punctatus*). Other centrarchids that were present in the Conservation Areas, but not observed spawning on the levee berm were: warmouth (*Chaenobryttus gulosus*), dollar sunfish (*Lepomis marginatus*), bluespotted sunfish (*Enneacanthus gloriosus*), black crappie (*Pomoxis nigromaculatus*), and the Everglades pygmy sunfish (*Elassoma evergladei*).

During the period between December 1960 and September 1961, counts of bass nests were made over a 10-mile section of levee berm (Table 1). The marsh extended directly to this levee and because of the thick vegetation, only limited sections of the berm were visible. Counts were made in the same sections each time. The completion of an additional levee in September caused the area where the counts were made to become dry, consequently losing its fishery value. Thereafter, observations were made along a new interior levee to the north. The new levee had a 125-foot wide canal adjacent to it which made observations possible along its entire length. However, actual counts were impractical because of wind action on the water surface and the great numbers of spawning fish at certain times of the year. Therefore, only gen-

eral notes regarding the relative abundance of each species were made.

TABLE 1

Counts of bass nests along 10 miles of levee in Conservation Area 2, Broward and Palm Beach counties, Florida. Water temperature was recorded 12 inches below the surface at mid-day

Date	Nests with bass	Nests without bass	Water temperature
1960			
Dec. 4	0	0	72 F (Dec. 1)**
Dec. 14	0	0	62 F (Dec. 19)**
1961			
Jan. 26		Numerous	60 F (Jan. 23)**
Feb. 10	56	63	70 F (Feb. 7)**
Feb. 16	104	133	65 F
Feb. 23	50	102	74 F
Mar. 3	20	35	76 F
Mar. 10	28	35	64 F
Mar. 16	67	73	70 F
Mar. 23	13	14	79 F
April 5	26	*	78 F
April 13	25	*	79 F
April 18	12	*	80 F
May 3			82 F
through	0	0	to
Aug. 31			92 F

*It was not possible to discern between vacant bass nests and nests vacated by other centrarchids on these dates.

**Frish, Harry M. 1962. Annual water quality variations at certain points in the Everglades. Florida Game and Fresh Water Fish Comm., Tallahassee, 14 pp. (mimeographed report).

SPAWNING

Largemouth Bass. The largemouth bass is the first of the centrarchids to spawn each year in south Florida. Spawning usually commenced when the water cooled to the low 60's F. During the period of the investigation, these temperatures occurred between mid-December and mid-January. Clugston (1964) reported successful spawning of largemouth bass between November 15 and December 15, 1960, in a 1.2-acre pond located approximately 20 miles east of the Conservation Areas. February was the peak spawning month during every year of the study. Most bass spawn-

ing occurred when the water temperature neared 70 F, and all spawning appeared to stop when the water temperature rose above 80 F. The bass ceased spawning along the levees by April 1st in 1960, 1962, and 1964, and by May 1st in 1961 and 1963. The spawning season ranged between 2.5-4.0 months in lengths. The general spawning pattern observed each year corresponded closely with the 1960-1961 season shown in Table 1. The location of nests at least 10 feet from each other showed the characteristic territorial behavior of the largemouth bass. Most of the bass nests were observed in water 12-30 inches deep.

Bluegill and Redear Sunfish (Shellcracker). The spawning requirements and habits of these two species are quite similar. Therefore, it was not always possible to distinguish which of the two species was being observed. Generally the bluegill and redear sunfish started spawning in late February or early March when the water temperature approached 70 F. Nests were most abundant when the water temperature was between 75-80 F, but on a number of occasions, they were observed spawning when the water temperature was 90 F. Spawning along the levee appeared to cease by October 1. The spawning season normally lasted 6-7 months, although during this period, there might often be times when they ceased spawning for 1-3 weeks.

Counts were made on three occasions in 1964 to illustrate the great numbers of the smaller sunfishes spawning along the interior levee. The total number of nests observed were: 1,284 on April 10; 1,373 on April 24; and 724 on June 9. These counts included bluegill, redear sunfish, and spotted sunfish. In April the mid-day water temperature was 75-77 F. By June 9, the temperature had risen to 86 F.

The bluegill and redear sunfish are community spawners. Frequently, when the nests were only a few inches from each other, the area appeared as one large nest 6 or more feet in diameter. The nests were usually found in water 18 to 36 inches deep.

Spotted Sunfish (Stumpknocker). The spawning season of the spotted sunfish in the Everglades is difficult to define. This species spawned intermittently throughout the spring and summer and until November in 1963. They were found spawning in small numbers when the mid-day water temperature was 64 F. More commonly, they started to spawn in fair numbers when the water temperature neared 75 F in March or April. The preferred spawn-

ing temperature range appeared to be 80-85 F. Spotted sunfish were observed spawning in great numbers on August 31, 1961, when the water temperature was 92 F. However, during the same year, no spotted sunfish could be found spawning from mid-June until the end of July when the mid-day water temperature ranged between 86-89 F.

This species generally fanned out its nests within one foot of the shore in water that was only 6 inches deep. They were the most pugnacious of the centrarchids observed. Bass, bluegill, and redear sunfish would usually flee the nest and wait in the shadows until the observer left the area before returning to the bed. The spotted sunfish would dart away from the nest, but return almost at once to stay over the eggs. On a number of occasions, they returned while the observer was holding a thermometer in the nest.

DISCUSSION

Great numbers of largemouth bass, bluegill, redear sunfish, and spotted sunfish were observed spawning along the levees of Conservation Area 2. The observed maximum spawning seasons varied from 4 months for the largemouth bass to 8 months for the spotted sunfish. November was the only month in which no centrarchid spawning was observed.

It is known that both light and temperature play an important part in controlling the reproductive cycle of many fishes. Centrarchids normally are predisposed to spawn during a lengthening photoperiod and increasing temperature. Many have observed that bass spawning occurs first in the spring when the water temperature warms to 60-65 F. Bass spawning may start in mid-May in Wisconsin (Mraz, Kmiotek, and Frankenberger, 1961) and in mid-April in Alabama (Swingle and Smith, 1950). In central Florida (latitude 28-29° N) it appears that bass spawning occurs in March and April (Carr, 1942; Horel, 1951; McLane, 1955) although they have been observed spawning "as early as January" in the St. Johns River (McLane, *op. cit.*). In south Florida (latitude 26° N.) bass spawning commenced in the coolest period of the year, *i.e.*, during December or January. The water temperature apparently must drop to nearly 60 F, or approximately the same temperature that the water must warm to in the cooler latitudes, before spawning begins. This is also the period of the least day-

light hours. However, bass spawning increases as the daylight hours become longer and until the water temperature increases to around 70 F.

Aronson (1957), in reviewing the work of other investigators, discusses many ecological factors which may affect the reproductive habits of fishes. He breaks these into three major headings: meteorological, habitat, and social. The more irregular spawning described for the smaller sunfishes suggests that factors in addition to photoperiod and temperature contribute to their reproductive pattern although no specific items were detected in this study.

The depth of the water in most of the marsh is not too deep for centrarchid spawning anytime throughout the year. Because of the dark bottom (peat) of the marsh and the thick vegetation, it was not possible to determine the degree to which the many centrarchid species used the marsh for spawning. All of the species observed spawning on the berm were also seen spawning on the peat or roots of the vegetation in the marsh. The great numbers of fry of all centrarchids that were found many miles from the levees while taking population estimates (Clugston and Dineen, unpublished data) indicate that spawning occurred over the entire area.

Lowering of the water level occurs during much of the spawning season, but it occurs at such a slow rate that it does not appear to affect the spawning adversely in any way. During May and June, when the water level was at its lowest, all species except the largemouth bass were seen spawning. However, from April through August, bass fry 1-1.5 inches long were observed in the marsh a number of times. Perhaps, because of the greater water depths and the shade afforded by the dense vegetation, the water may remain sufficiently cool in the marsh to encourage bass spawning at a date later than actually observed.

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